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ADDENDUM MEMORANDUM

Attention:	Jonathon Barker, Principal Environmental Approvals Sarah Thomas, Environmental Manager	From:	Dr Elliott Duncan
Company:	De Grey Mining	Date:	04 October 2024
Subject:	Results of Ecotoxicity Testing on Hemi Dewater Discharge Water	Project:	Hemi Dewater Discharge Tier 3 ERA

1. BACKGROUND AND SCOPE

1.1 BACKGROUND

The Hemi Gold Project (Hemi) is located within the larger Mallina Gold Project (MGP) which encompasses six defined mineralised gold zones (Toweranna, Mallina, Withnell, Mt Berghas, Hemi and Wingina) across a 1,200-km^2 area. Across the area there is an estimated mineral resource of approximately 37.4 million tonnes grading 1.8 g/t gold for 2.2 million ounces.

Dewatering associated with pit development at Hemi is likely to result in large volumes of excess water being produced for approximately 3 years prior to ore processing taking place. This is largely a consequence of the proposed development occurring in an area containing a shallow water table (<5 metres below ground level (mbgl)). Consequently, surplus water of approx. 30 GL will need to be managed. Based on the characteristics of the Hemi site, the most viable option to manage this water is a controlled discharge via constructed earth ponds into the nearby Turner River (approx. 14 km to the east). In order to assess the ecological suitability of this approach a Tier 2 Environmental Risk Assessment (ERA) was undertaken and reported by MBS Environmental in August 2024 (MBS 2024).

During the process of an initial assessment MBS (and others such as Stantec), identified that the proposed raw surface water discharge was likely to contain elevated levels of uranium (U) and vanadium (V) concentrations in excess of baseline concentrations in the Turner River. Arsenic was also present but at lower concentrations overall. Levels of uranium, in particular, triggered a need for assessment of potential radiological dose assessment as well as uranium chemical toxicology effects for potential receptors — humans, fauna, aquatic fauna and vegetation.

MBS thus conducted a series of bench experiments and a Tier 2 (site-specific) assessment for the project in order to demonstrate that the planned discharge will have no deleterious ecological/human health effects. This assessment included two sets of bench experiments to establish the chemistry of discharge water after firstly running the water through a constructed pond to naturally react and attenuate arsenic, vanadium, uranium levels by sorption onto the soil, and secondly applying iron oxide and/or phosphate materials as an attempt to adsorb and thus remove all three contaminants of interest from solution. The major outcomes from the Tier 2 ERA (MBS 2024, which this is intended as an addendum to) included:

- The proposed discharge will travel approximately 50 km downstream in the absence of rainfall and will be constrained within a 50 – 90-m channel.
- Conservative site and regional specific guideline values for both uranium (5 to 19 µg/L respectively) and vanadium (8 to 11 µg/L respectively) were developed based off long term monitoring of the Turner and Yule (neighbouring) river systems.
- Without water treatment and under low-rainfall conditions (no dilution), uranium (approx. 31 µg/L) and vanadium (approx. 32 µg/L) concentrations in the Turner River (post-discharge) would exceed both interim site-specific and regional trigger values (which were calculated to be in the 5 to 19-µg/L range for U and 8 to 11-µg/L range for V).
- In average to high rainfall years (approx. 28 GL in catchment/year), uranium concentrations in the Turner River post-discharge were predicted to be approximately 12 µg/L which still exceeded the site-specific trigger value of 5.6 µg/L.
- Based on laboratory experiments, native iron oxide concentrations in project area soils in a constructed pond were sufficient to treat and decrease both arsenic and vanadium concentrations to below the calculated site-specific and regional trigger values.
- Uranium concentrations, however, were unable to be reduced below site-specific and regional trigger values when exposed to native iron oxide minerals or treated with iron oxides as a water treatment approach. It was hypothesized that the high alkalinity and hardness of both the discharge and receiving water resulted in the bulk of uranium being present in uranyl carbonate forms, which are highly soluble and resistant to removal via adsorption on mineral surfaces.

Based on these results, De Grey in conjunction with MBS Environmental engaged Ecotox Servies Australia (ESA) to undertake a series of ecotoxicological tests on representative discharge water (direct toxicity assessment (DTA)) to further understand the potential impacts of the proposed discharge on aquatic biota within the Turner River ecosystem.

1.2 SCOPE

This addendum memorandum outlines the results of ecotoxicological testing on representative discharge water to determine whether the proposed discharge into the Turner River is likely to affect organisms that utilise this environment as a habitat. The scope of work conducted by MBS Environmental included:

- Liaising with Ecotox Servies Australia (ESA) to understand the capabilities of the laboratory and the types of experiments required to address the suitability of the proposed discharge.
- Planning and designing the relevant ecotoxicology experiments in conjunction with ESA.
- Assisting De Grey with the collection and transportation of materials (e.g. discharge water) to ESA laboratories (Lane Cove, NSW) for use in experiments.
- Interpreting the results of the ecotoxicity experiments (Attachment 1) and preparing a memorandum (this document) outlining the key findings of the ecotoxicology testwork and recommendations for the proposed discharge. This will form an addendum to the existing Tier 2 ERA document, which will convert the ERA to a Tier 3 assessment given that a direct ecotoxicological assessment of the discharge water has been conducted.

2. URANIUM CHARACTERISTICS IN PROJECT AREA WATER SOURCES

Key characteristics of measured and predicted uranium concentrations and other analytes of interest in project area water sources are provided below in Table 1.

Table 1: Summary of Key Chemical Data from Water Sources Relevant to This Assessment

Water Source	Treatment	Uranium (µg/L)			pH (pH Units)			Total Alkalinity (mg/L as $CaCO_3$)			Total Hardness (mg/L as $CaCO_3$)		
		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Groundwater	Project Area	27.9	5.2	84.1	8.10	7.44	9.10	360	194	582	289	82	1,010
Discharge Water	Raw	30.1	28.5	31.6	8.22	8.20	8.23	353	349	357	265	263	267
	Post Pond Treatment	28.3	25.0	32.0	8.47	8.10	8.70	370	356	381	265	251	282
Turner River	Baseline	3.9	0.5	16.0	8.50	7.74	9.41	225	48	496	163	43	383
	*Post discharge: no rainfall	29.9	-	-	8.24	-	-	369	-	-	269	-	-
	*Post discharge: median annual rainfall	17.2	-	-	8.36	-	-	299	-	-	225	-	-
	*Post discharge: average annual rainfall	8.9	-	-	8.45	-	-	252	-	-	196	-	-
	*Post discharge: maximum annual rainfall	5.1	-	-	8.49	-	-	231	-	-	183	-	-
Yule River	Baseline	7.4	<0.1	58.0	8.42	7.59	9.00	404	76	1,580	227	51	1,023

* Calculated value.

Key points from Table 1 regarding the ecotoxicology experiments which are the focus of this memo include:

- Uranium concentrations in regional groundwater, the proposed discharge water (pre and post treatment via a pond system) was typically in the 28 – 32-µg/L range. This was far higher than average concentrations present in the Turner (average: 3.9 µg/L) or Yule (average: 7.4 µg/L) river systems.
- Uranium concentrations in the Turner River were predicted to be between 5 – 30 µg/L, depending on the extent of rainfall within the catchment during the discharge window.
- Project area groundwater, the proposed discharge water plus the water in the receiving environment (Turner River) are all of alkaline pH and have relatively high total alkalinity (high carbonate concentrations) and hardness values.

3. CONDUCTION OF ECOTOXICOLOGY EXPERIMENTS

3.1 EXPERIMENTAL APPROACH

The approach to the conduction of ecotoxicology experiments to support the existing Tier 2 ERA was as follows:

- Identify a groundwater source for sampling from the proposed dewater area based on previous works which has similar chemical characteristics to the proposed typical discharge water (Table 1).
- Incubate groundwater in a simulated soil-holding pond (as proposed in MBS 2024 Tier 2 ERA) to mimic the proposed process during discharge, and also allow for the removal of As and V from the discharge water as outlined in the ERA report (MBS 2024).
- Perform ecotoxicity tests using the post-incubated groundwater exposing a range of Pilbara-based species which encompass algae, invertebrates and fish. Ecotoxicity tests were designed to mimic the predicted post-discharge concentrations in the Turner River as outlined in Table 1.

3.2 PREPARATION OF EXPERIMENTAL MEDIA

In order to ensure that experiments mimic the proposed discharge process as closely as possible, selected and sampled groundwater was incubated/held in a simulated soil-holding pond prior to use in ecotoxicity experiments. These experiments essentially mimicked those described in the ERA report (MBS 2024) with the general process being as follows:

- Approximately 40 L of water from the HMB001 bore (used in past testwork during the ERA, MBS 2024) was stored in two 25-L plastic containers: 20 L in each container.
- Approximately 4 kg of typical site soil from the likely location of the soil holding ponds (HMRC492 location used in past testwork, MBS 2024) was also collected with 2 kg added to each of the 20-L water samples.
- The soil-water solution was then incubated for five (5) hours and re-suspended/agitated slightly every 30 minutes. After five hours incubation the supernatant/water was separated and filtered for use in ecotoxicology experiments.

A summary of the chemical characteristics of the experimental media is presented in Table 2.

Table 2: Composition (Key Analytes) of Treated Discharge Water (Non-diluted) Used in Ecotoxicity Experiments

Analyte	Units	Concentration
pH	pH Units	8.1
EC	µS/cm	174
Alkalinity (Total)	mg/L (as $CaCO_3$)	380
Hardness		260
Sulfate	mg/L	56
Chloride		200
Calcium		34
Magnesium		43
Potassium		10
Sodium		210
Uranium	µg/L	33
Arsenic		2
Vanadium		5

3.3 ECOTOXICOLOGY TESTS

3.3.1 Tests Conducted

A total of five ecotoxicological tests were performed on the proposed discharge water to assess whether the proposed treated groundwater discharge will have any effects on biota living within the Turner River system. All the test-species chosen were either native Pilbara species or species originating from Northern Australia. All tests were conducted by Ecotox Services Australia (Lane Cove, NSW, Australia). A summary of the tests is provided below in Table 3, the report is included as Attachment 1.

Table 3: Summary of Ecotoxicity Testwork

Test Number	Species	Taxonomic Group	Experimental Period	Number of Replicate Experiments	Endpoint(s)
ESA SOP 102	Freshwater cladoceran *(Ceriodaphnia dubia)*	Crustacean	7 days	10	Mortality Offspring survival rates
ESA SOP 126	Rainbowfish *(Melanotaenia splendida splendida)*	Fish	12 days	4	Embryo viability
ESA SOP 125	Freshwater hydra (*Hydra viridissima)*	Cnidaria	96 hours	4	Population growth rate
ESA SOP 112	Freshwater aquatic duckweed (*Lemna aequinoctialis*)	Flowering Plants	96 hours	4	Growth rate
ESA SOP 103	Green algae (*Chlorella* sp.)	Algae	72 hours	4	Population size

3.3.2 Dilutions

In order to ensure that the potential toxicity of the proposed discharge was tested across the possible environmental (i.e. catchment rainfall) scenarios outlined in Table 1 (as well as to estimate direct toxicity endpoints), a series of dilutions was performed on the proposed discharge water as summarised below in Table 4. Dilutions were conducted using the hard dilute mineral water (HDMW) standard developed by ESA to produce final concentrations that were 60%, 40%, 20% and 2% of the initial (undiluted) concentrations (i.e. 40%, 60%, 80% and 98% dilutions). Analysis report is provided as Attachment 2. These dilutions were selected to match the predicted uranium concentrations in the Turner River post discharge under different rainfall scenarios as outlined in Table 1. In these tests, evapoconcentrative effects on the discharge water (concentrations above 100% of original) were not considered for the following reasons:

- There is potential for evapoconcentration effects along the exposed surface water pathway (increasing concentrations of uranium and other species), however this is effectively countered or (more likely) exceeded by dilution through mixing with the underlying/inflowing regional groundwater and anyway rainwater inflow along the flowpath.
- The proposed discharge will result in a constant amount of water being added to the Turner River over the three-year discharge period resulting in evapoconcentrative effects being reduced — water is continually flushing and salt accumulation and then re-release is not considered to be a factor.
- Evapoconcentration would not change the species present (calcium uranyl carbonates) and would also increase hardness and general ions which reduce toxicity as per previous discussions. Based on observed concentrations in groundwater and bench tests, the concentrations of uranium are also indicated to be near saturated (at maximum) before removal from solution by precipitation. Significantly higher concentrations in the surface water/groundwater of the Turner River are therefore not considered likely.

Table 4: Details of Composition of Dilution and Discharge Water Used in Ecotoxicology Experiments

Analyte	Units	Dilution Water (HDMW)	Discharge Water				
			No Dilution	40% Dilution	60% Dilution	80% Dilution	98% Dilution
pH	pH Units	8.1	8.1	8.1	8.1	8.1	8.1
EC	µS/cm	340	1,426	995	780	561	378
Alkalinity (Total)	mg/L (as $CaCO_3$)	160	380	300	250	210	160
Hardness		180	260	220	200	180	170
Sulfate	mg/L	10	56	38	30	20	11
Chloride		9	200	120	87	48	17
Calcium		68	34	47	52	58	64
Magnesium		2	43	26	18	10	2
Potassium		1	10	6	5	3	5
Sodium		5	210	120	78	43	9.3
Uranium	µg/L	0.6	33	20	14	7.3	1.3
Arsenic		<1	2	<1	<1	<1	<1
Vanadium		<1	5	3	2	1	<1

3.3.3 QAQC Measures

Relevant quality control measures performed during the ecotoxicological tests included:

- The use of the hard dilute mineral water (HDMW) standard as a dilution medium to prepare solutions that mirror the predicted composition (high hardness) of the Turner River post discharge.
- The conduction of control experiments for all ecotoxicological tests which were conducted in both the hard dilute mineral water (HDMW) and a dilute mineral water (DMW) solution. These controls were utilised to ascertain:
  - Baseline ecotoxicological endpoint parameters (Table 3) for all tested organisms under 'ideal' conditions.
  - Whether the increased hardness/alkalinity of the HDMW dilution water has any influence on ecotoxicological endpoints in the absence of the contaminants of interest i.e. uranium.

3.3.4 Statistical Endpoint Values and Definitions

The following statistical measurements were used to assess the results of ecotoxicology tests and provide an indication of uranium concentrations that have the potential to inhibit biota at the population scale. These include:

- EC10: 10% effect concentration i.e. concentration of contaminant of interest (i.e. uranium) which affects (i.e. kills, inhibits growth, reduces offspring viability etc) 10% of the organisms within the test.
- EC50: 50% effect concentration i.e. concentration of contaminant of interest which affects (depending on the endpoint) 50% of the organisms within the test.
- LOEC: Lowest observed effect concentration i.e. lowest concentration of contaminant of interest which causes an effect (depending on the endpoint) on organisms within the test.
- NOEC: No observable effect concentration i.e. highest concentration of contaminant of interest which was observed to not affect (depending on endpoint) organisms within the test.

4. KEY RESULTS OF ECOTOXICOLOGY TESTS

From the data presented in Table 5, the proposed groundwater discharge water (at any dilution) had no deleterious effects on any test organisms across any of the tests.

For all tests, there were no differences in endpoint measures/values in organisms exposed to the undiluted discharge water (i.e. 33 µg/L uranium) to those cultured in the HDMW control (0.6 µg/L uranium). Consequently, all ecotoxicological statistical endpoint values i.e. EC10, EC50 and LOEC were greater than 33 µg/L uranium, whilst the NOEC value was at least 33 µg/L uranium.

Based on the results of these direct toxicity assessment tests, it is therefore highly unlikely that the planned discharge will have any deleterious effects on biota within the Turner River system. These findings support the hypothesis that the high alkalinity/hardness within the proposed discharge water and the Turner River receiving water results in the uranium being present as less toxic uranium (uranyl) carbonate ion species, which is supported by literature data (Nakajima et al. 1979, Poston et al. 1984, Greene et al. 1986).

If evaporative conditions were to prevail (despite expected dilution with groundwater along the flowpath discussed above), it is likely that concentrations of uranium (and other elements) would exceed those tested here. Under these conditions however, it is still unlikely that significant ecotoxicological effects would occur given that parameters such as hardness and alkalinity are also likely to increase, resulting in uranium still being present as less toxic uranium (uranyl) carbonate ion species.

Table 5: Summary of Key Results from Ecotoxicology Tests

Test	Organism	Endpoint and Measure	No Dilution	40% Dilution	60% Dilution	80% Dilution	98% Dilution	HDMW Control	DMW Control	Ecotox Measures (EC10, EC50, LOEC, NOEC) (µg U/L)
			33 µg/L U	20 µg/L U	14 µg/L U	7.3 µg/L U	1.3 µg/L U	0.6 µg/L U	<0.5 µg/L U	
ESA SOP 102	Cladoceran	Survival (% unaffected)	100 ± 0	90 ± 32	100 ± 0	100 ± 0	100 ± 0	90 ± 32	90 ± 32	All ≥33 µg U/L
ESA SOP 102		Offspring viability (count)	16.6 ± 1.7	14.0 ± 5.2	16.0 ± 1.1	14.8 ± 1.4	16.2 ± 2.0	14.2 ± 5.2	14.2 ± 5.1	All ≥33 µg U/L
ESA SOP 126	Rainbowfish	Embryo viability (% unaffected)	90 ± 12	90 ± 20	90 ± 12	85 ± 10	90 ± 12	85 ± 10	90 ± 12	All ≥33 µg U/L
ESA SOP 125	Hydra	Population growth rate (% change over time)	0.30 ± 0.02	0.30 ± 0.02	0.29 ± 0.02	0.30 ± 0.03	0.29 ± 0.01	0.29 ± 0.02	0.30 ± 0.02	All ≥33 µg U/L
ESA SOP 112	Duckweed	Growth rate (% change over time)	0.38 ± 0.02	0.38 ± 0.02	0.34 ± 0.01	0.38 ± 0.02	0.36 ± 0.02	0.36 ± 0.02	N/A	All ≥33 µg U/L
ESA SOP 103	Green Algae	Cell yield (x10^4 cells/mL)	69.1 ± 1.8	68.3 ± 2.0	68.6 ± 1.8	68.6 ± 2.4	67.4 ± 2.6	68.2 ± 2.1	N/A	All ≥33 µg U/L

5. TIER 3 ERA

The conduction of direct toxicity assessment ecotoxicology experiments allows the previous ERA (MBS 2024) to now be classified as Tier 3, given that laboratory exposure experiments utilising the water that is intended for discharge have been conducted. Within the Tier 2 ERA (MBS 2024), the release of metal(loid) contaminants (in particular uranium), into the Turner River system was assessed to be a high inherent risk and the key residual risk remaining following discharge treatment through earthen ponds and other controls. This was based on:

- Uranium concentrations in the proposed discharge water (circa 30 µg/L) and in the Turner River post discharge (circa 12 – 29 µg/L) exceeding both the low reliability ANZG (2018) default freshwater species protection value (0.5 µg/L), and the calculated site specific (Turner River) and regional (Turner and Yule Rivers) guideline values (12 – 19 µg/L uranium) in low to average rainfall years.

Thus, if the proposed Turner River discharge were to take place, it is likely that elevated uranium concentrations (with respect to background concentrations in the Turner River) will be present in the Turner River for an extended period post discharge. Based on the results of these tests, the effects on aquatic biota are, however, likely to be insignificant.

The inherent risk to other identified receptors such as, terrestrial fauna (including livestock), floodplain soils/vegetation was considered to be very low in the Tier 2 ERA. This was due to predicted concentrations in the Turner River post pond discharge being well below any animal/human drinking water guideline values (i.e. ANZECC livestock drinking water, long-term irrigation, NHMRC human drinking water guidelines) and also that flooding/inundation of adjacent soils was considered unlikely to occur or be significant in duration even under extreme rainfall scenarios (MBS 2024).

Consequently, based on the newly provided information in this report, the inherent (and hence also residual) risk to all potential ecological receptors within the Turner River system is very low. On this basis it is, therefore, highly unlikely that the planned discharge will have any notable effect on the ecological function of the river system. Furthermore, as highlighted in the Tier 2 ERA report, catchment rainfall is likely to further dilute uranium and other metal(loids) within the river system to concentrations well below those required to have ecotoxicological effects on aquatic and terrestrial biota at the population scale.

Yours sincerely
MBS Environmental

Dr Elliott Duncan
Senior Environmental Geochemist

Encl.: Attachment 1: Chain of Custody and Ecotox Lab Report
Attachment 2: Analysis of Water and Diluent Water
Attachment 3: Teir 3 ERA Tables

6. REFERENCES

ANZG. 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian State and Territory Governments. www.waterquality.gov.au/anz-guidelines.

Greene B, Henzl MT, Hosea JM & Darnall DW 1986. Elimination of bicarbonate interference in the binding of U(VI) in mill-waters to freeze-dried *Chlorella vulgaris*. Biotechnology and Bioengineering 28, 764–767.

MBS, 2024. Hemi Gold Project - Turner River Dewater Discharge - Tier 2 Environmental Risk Assessment. Internal report prepared for De Grey Mining Pty Ltd. 13 August 2024.

Nakajima A, Horikoshi T & Sakaguchi T 1979. Ion effects on the uptake of uranium by *Chlorella regularis*. Agricultural Biology and Chemistry 43, 625–629

Poston TM, Hanf RW & Simmons MA 1984. Toxicity of uranium to *Daphnia magna*. Water Air and Soil Pollution 22, 289–298.

ATTACHMENT 1: CHAIN OF CUSTODY AND ECOTOX LAB REPORT

Chain-of-Custody / Service Request Form

Datasheet ID: 601.1
Last Revised: 14 December 2022

Customer: MBS Environmental
Contact Name: Elliott Duncan
Phone: 0431617821 Email: educan@mbsenvironmental.com.au (please provide an email address for sample receipt notification)
Purchase Order: DEGERAETX

Ship To: Ecotox Services Australia - Unit 27, 2 Chaplin Drive, Lane Cove West, NSW, 2066
Attention: Dr Rick Krassoi

Sample Date (day/month /year)	Sample Time	Sample Name (exactly as written on the sample vessel)	Sample Method (eg. Grab, composite etc.)	Number and Volume of Containers (eg 2 x 1L)	Tests Requested (See reverse for guidance)						Comments / Instructions
											Note that testing will be delayed if an incomplete chain of custody is received • Additional treatment of samples (i.e. spiking) • Sub-contracted services (i.e. chemical analyses) • Dilutions required (if different than 100% down to 6.25%) • Sample holding time restriction (if applicable) • Sample used for litigation (if applicable) *Note: An MSDS must be attached if Available* **ESA Project Number: PR_____**
11/08/2024	9:30	Discharge Water	N/A	2 x 17L							Please Conduct as per quote - PL02554
											Please see attached experimental instructions

1) Released By:	Date:	2) Received By:	Date:	3) Released By:	Date:	4) Received By:	Date:
Liam Fell	12/08/2024						
Of:	Time:	Of:	Time:	Of:	Time:	Of:	Time:

Note that the chain-of-custody documentation will provide definitive information on the tests to be performed.

Chain-of-Custody / Service Request Form

Datasheet ID: 601.1
Last Revised: 14 December 2022

ESA Routine Toxicity Tests

Toxicity Test Type	Test Organism	Toxicity Test	Test Code
Freshwater	Algae	72-hr *Raphidoculis subcapitata* growth inhibition	Algal growth *Rs*
		72-hr *Chlorella sp* growth inhibition	Algal growth *Cl*
	Cladoceran	48-hr acute *Ceriodaphnia dubia* survival	Acute Cerio
		7-day *Ceriodaphnia dubia* partial life-cycle	Chronic Cerio
	Duckweed	7-day *L. disperma* growth test	Duckweed *Ld*
		4-days *L.aequinoctialis* growth test	Duckweed *La*
	Fish	96-hr Rainbowfish fish imbalance test	Acute fish
		12-days embryo devt. And post-hatch survival	Embryo fish
	Midges	48-hr survival *Chironomidus tepperi*	Acute Midge
		7-d growth *Chironomidus tepperi*	Chronic Midge
	Shrimp	96-hr shrimp *Macrobrachium australiense*	Shrimp *Ma*
		96-hr shrimp *Macrobrachium bullatum*	Shrimp *Mb*
		96-hr shrimp *Paratya australienis*	Shrimp *Pa*
	Hydra	96-h reproduction *Hydra virridissima*	Green Hydra
		96-h reproduction *Hydra lumbriculus*	Brown Hydra
Whole-Sediment	Amphipod	10-day acute *Melita plumulosa* toxicity	Amphipod WS test
Marine	Clam	10-day acute *Tellina deltoidalis* toxicity	Acute clam WS test

Toxicity Test Type	Test Organism	Toxicity Test	Test Code
Marine	Algae	72-hr growth inhibition using *Nitzschia closterium*	Algal growth *Nc*
		72-hr growth inhibition using *Tisochrysis lutea*	Algal growth *Tl*
		72-hr germination success using *Hormosira banksii*	Algal germination *Hb*
		72-hr germination success using *Ecklonia radiata*	Algal germination *Er*
		14-day growth using *Hormosira banksii or Ecklonia radiata*	Algal growth *Hb* or *Er*
	Amphipod	96-hr acute amphipod survival using *Melita plumulosa*	Acute amphipod *Mp*
		96-hr acute amphipod survival using *Allorchestes compressa*	Acute amphipod *Ac*
	Bivalve	48-hr larval development using Sydney rock oyster	SRO larval development
		48-hr larval development using Pacific oyster	PO larval development
		48-hr larval development using Milky oyster	MO larval development
		48-hr larval development using Mussel	Mussel larval development
	Copepod	48-hr Acute copepod Acartia sinjiensis	Copepod Acartia
		48-hr Acute copepod *Parvocalanus crassirostris*	Copepod Parvo
	Fish	96-hr fish imbalance using *Lates calcarifer*	Acute FIT
		7-day fish imbalance and growth using *Lates calcarifer*	Chronic FIT
	Microtox	Acute Microtox toxicity using *Vibrio fisheri*	Microtox
	Prawn	96-hr Tiger prawn *Penaeus monodon* acute toxicity	Acute Prawn
	Sea Urchin	1-hr sea urchin fertilisation success	Urchin Fertilisation
		72-hr sea urchin larval development	Urchin Larval development
	Sea Anemone	48-h acute toxicity using *Exaiptasia pulchella*	Acute Anemone
		8-d pedal lacerate growth using *Exaiptasia pulchella*	Chronic Anemone
Terrestrial	Earthworm	14- day earthworm toxicity tests	Acute earthworm
		Earthworm reproduction test	Chronic earthworm
	Plant	Plant germination / growth/ root elongation	Plant germination/ elongation

Ecotox Services Australia . Unit 27, 2 Chaplin Drive, Lane Cove NSW 2066 AUSTRALIA
Phone: 61 2 9420-9481 Email: info@ecotox.com.au

Toxicity Assessment of a Discharge Sample

MBS Environmental

Test Report

September 2024

T +61 2 9420 9481
Unit 27, 2 Chaplin Drive
Lane Cove NSW 2066 Australia
www.ecotox.com.au
ECOTOX SERVICES AUSTRALIA PTY LIMITED
ABN 95 619 426 201

Toxicity Test Report: TR2254/1

Accredited for compliance with ISO/IEC 17025

Client:	MBS Environmental 4 Cook St West Perth WA 6005	**ESA Job #:** **Date Sampled:** **Date Received:**	PR2254 11 August 2024 14 August 2024
Attention:	Elliott Duncan	**Sampled By:**	Client
Client Ref:	PO-DEGERAETX	**ESA Quote #:**	PL2254_q01

Lab ID No.:	Sample Name:	Sample Description:
11676	Discharge Water	Aqueous sample, pH 8.1*, conductivity 174µS/cm*, total ammonia <2.0mg/L*. Sample received at 14ºC* in apparent good condition.

*NATA accreditation does not cover the performance of this service

Test Performed:	Partial life-cycle toxicity test using the freshwater cladoceran *Ceriodaphniaf dubia*
Test Protocol:	ESA SOP 102 (ESA 2016), based on USEPA (2002) and Bailey *et al*. (2000)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was serially diluted with Hard Dilute Mineral Water (HDMW) to achieve the test concentrations. A DMW control (Dilute Mineral Water culture media) and a HDMW control were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	16 August 2024 at 1830h

Sample 11676: *Discharge Water*

Concentration (%)	% Unaffected at 7 days (Mean ± SD)
DMW Control	90.0 ± 31.6
HDMW Control	90.0 ± 31.6
2	100 ± 0.0
20	100 ± 0.0
40	100 ± 0.0
60	90.0 ± 31.6
100	100 ± 0.0

7 day EC10 (unaffected) = >100%
7 day EC50 (unaffected) = >100%
NOEC = 100%
LOEC = >100%

Sample 11676: *Discharge Water*

Concentration (%)	Number of Young (Mean ± SD)
DMW Control	14.2 ± 5.1
HDMW Control	14.2 ± 5.2
2	16.2 ± 2.0
20	14.8 ± 1.4
40	16.0 ± 1.1
60	14.0 ± 5.2
100	16.6 ± 1.7

7 day EC10 (unaffected) = >100%
7 day EC50 (unaffected) = >100%
NOEC = 100%
LOEC = >100%

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % unaffected	≥80.0%	90.0%	Yes
Control mean number of young per surviving adult	≥15.0	15.8	Yes
Reference Toxicant within cusum chart limits	185.6-210.7KCl/L	203.7KCl/L	Yes

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Test Report Authorised by: Dr Rick Krassoi, Director on 5 September 2024

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

Citations:

Bailey, H.C., Krassoi, R., Elphick, J.R., Mulhall, A., Hunt, P., Tedmanson, L. and Lovell, A. (2000) Application of *Ceriodaphnia cf. dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. *Environmental Toxicology and Chemistry* 19:88-93.

ESA (2016) ESA SOP 102 – *Acute Toxicity Test Using Ceriodaphnia dubia.* Issue No 11. Ecotox Services Australasia, Sydney, NSW.

USEPA (2002) *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms.4th Ed.* United States Environmental Protection Agency, Office of Water, Washington DC.

Toxicity Test Report: TR2254/2

Client:	MBS Environmental	**ESA Job #:**	PR2254
	4 Cook St	**Date Sampled:**	11 August 2024
	West Perth WA 6005	**Date Received:**	14 August 2024
Attention:	Elliott Duncan	**Sampled By:**	Client
Client Ref:	PO-DEGERAETX	**ESA Quote #:**	PL2254_q01

Lab ID No.:	**Sample Name:**	**Sample Description:**
11676	Discharge Water	Aqueous sample, pH 8.1, conductivity 174µS/cm, total ammonia <2.0mg/L. Sample received at 14ºC in apparent good condition.

Test Performed:	Rainbowfish embryo hatching test using *Melanotaenia splendida splendida*
Test Protocol:	ESA SOP 126 (2016), based on USEPA (2002), but adapted for use with native rainbowfish
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was serially diluted with Hard dilute mineral water (HDMW) to achieve the test concentrations. A DMW (Dilute Mineral Water) control and a HDMW control were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	16 August 2024 at 1900h

Sample 11676: *Discharge Water*	*Vacant*	*Vacant*
Concentration (%) / **% Unaffected (Mean ± SD)**		
DMW Control: 90.0 ± 11.6		
HDMW Control: 85.0 ± 10.0		
2: 90.0 ± 11.6		
20: 85.0 ± 10.0		
40: 90.0 ± 11.6		
60: 90.0 ± 20.0		
100: 90.0 ± 11.6		
12-d EC10 = >100%		
12-d EC50 = >100%		
NOEC = 100%		
LOEC = >100%		

QA/QC Parameter	**Criterion**	**This Test**	**Criterion met?**
Control mean % unaffected	≥80.0%	100%	Yes
Reference Toxicant within cusum chart limit	32.6-127.0µg Cu/L	70.4µg Cu/L	Yes

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Toxicity Test Report: TR2254/2

Test Report Authorised by: Dr Rick Krassoi, Director on 5 September 2024

Results are based on the samples in the condition as received by ESA.

Animal Research Authority:

Animal Research Authority CSB V20/10359 issued by the Animal Care and Ethics Committee of The Secretary, Department of Regional NSW, NSW Department of Primary Industries, valid from 11 May 2023 to 11 May 2028. Animal Research Establishment, Accreditation # 53051.

Citations:

ESA (2016) *SOP 126- Rainbowfish Embryo Hatching Test*. Issue N°6. Ecotox Services Australasia, Sydney NSW

USEPA (2002) *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms.4th Ed.* United States Environmental Protection Agency, Office of Water, Washington DC.

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Toxicity Test Report: TR2254/3

Client:	MBS Environmental	**ESA Job #:**	PR2254
	4 Cook St	**Date Sampled:**	11 August 2024
	West Perth WA 6005	**Date Received:**	14 August 2024
Attention:	Elliott Duncan	**Sampled By:**	Client
Client Ref:	PO-DEGERAETX	**ESA Quote #:**	PL2254_q01

Lab ID No.:	**Sample Name:**	**Sample Description:**
11676	Discharge Water	Aqueous sample, pH 8.1, conductivity 174µS/cm, total ammonia <2.0mg/L. Sample received at 14ºC in apparent good condition.

Test Performed:	96-hr acute toxicity test using the freshwater hydra *Hydra viridissima*
Test Protocol:	ESA SOP 125 (2016), based on Riethmuller et al. (2003)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	Sample was serially diluted with HDMW (Hard Dilute Mineral Water) to achieve the test concentrations. A conductivity-modified DMW (Dilute Mineral Water) control and a HDMW control were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	16 August 2024 at 2000h

Sample 11676: *Discharge Water* **Concentration (%)**	**Population Growth Rate (Mean ± SD)**	*Vacant*	*Vacant*
DMW Control	0.30 ± 0.02		
HDMW Control	0.29 ± 0.02		
2	0.29 ± 0.01		
20	0.30 ± 0.03		
40	0.29 ± 0.02		
60	0.30 ± 0.02		
100	0.30 ± 0.02		
96-hr EC10 = >100%			
96-hr EC50 = >100%			
NOEC = 100%			
LOEC = >100%			

QA/QC Parameter	**Criterion**	**This Test**	**Criterion met?**
Control mean population growth rate	≥0.259	0.30	Yes
Reference Toxicant within cusum chart limits	2.2-11.7µg Cu/L	5.6µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 5 September 2024

Results are based on the samples in the condition as received by ESA.

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Toxicity Test Report: TR2254/3

Citations:

ESA (2016) SOP 125 –*Hydra Population Growth Test.* Issue No 5. Ecotox Services Australasia, Sydney, NSW

Riethmuller N, Camilleri C, Franklin N, Hogan A, King A, Koch A, Markich SJ, Turley C and van Dam R (2003).

Green Hydra Population Growth Test. In: *Ecotoxicological testing protocols for Australian tropical freshwater ecosystems*. Supervising Scientist Report 173, Supervising Scientist, Darwin NT.

Toxicity Test Report: TR2254/4

Client:	MBS Environmental 4 Cook St West Perth WA 6005	**ESA Job #:** **Date Sampled:** **Date Received:**	PR2254 11 August 2024 14 August 2024
Attention:	Elliott Duncan	**Sampled By:**	Client
Client Ref:	PO-DEGERAETX	**ESA Quote #:**	PL2254_q01

Lab ID No.:	**Sample Name:**	**Sample Description:**
11676	Discharge Water	Aqueous sample, pH 8.1, conductivity 174µS/cm, total ammonia <2.0mg/L. Sample received at 14ºC in apparent good condition.

Test Performed:	96-hr Growth inhibition of the freshwater aquatic duckweed *Lemna aequinoctialis*
Test Protocol:	ESA SOP 112 (ESA 2016), based on ASTM (2012)
Test Temperature:	The test was performed at 29±2°C.
Deviations from Protocol:	Test volume reduced from 100ml to 15ml; Fronds per replicate reduced from 12-16 to 6; Replicates per treatment increased from 3 to 4.
Comments on Solution Preparation:	The sample was serially diluted with HDMW (Hard Dilute Mineral Water) with added CAAC media to achieve the test concentrations. A HDMW CAAC control was tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture, originally sourced from ERISS, NT.
Test Initiated:	16 August 2024 at 1800h

Sample 11676: *Discharge Water* **Concentration (%)**	**Specific Growth Rate (Mean ± SD)**	*Vacant*	*Vacant*
CAAC Control	0.36 ± 0.02		
2	0.36 ± 0.02		
20	0.38 ± 0.02		
40	0.34 ± 0.01		
60	0.38 ± 0.02		
100	0.38 ± 0.02		
96-hr IC10 = >100% **96-hr IC50 = >100%** **NOEC = 100%** **LOEC = >100%**			

QA/QC Parameter	**Criterion**	**This Test**	**Criterion met?**
Control Specific Growth rate	>0.231	0.36	Yes
Reference Toxicant within cusum chart limits	7.2-40.4mg/L	14.9mg/L	Yes

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Toxicity Test Report: TR2254/4

Test Report Authorised by: Dr Rick Krassoi, Director on 5 September 2024

Results are based on the samples in the condition as received by ESA.

Citations:

ESA (2016) *SOP 112 – Duckweed Growth Inhibition Test.* Issue No. 7. Ecotox Services Australasia, Sydney NSW

OECD (2006) *Lemna sp.* Growth Inhibition Test. Method 221. OECD Guideline for the Testing of Chemicals. Organisation for Economic Cooperation and Development, Paris

Toxicity Test Report: TR2254/5

Client:	MBS Environmental 4 Cook St West Perth WA 6005	**ESA Job #:** **Date Sampled:** **Date Received:**	PR2254 11 August 2024 14 August 2024
Attention:	Elliott Duncan	**Sampled By:**	Client
Client Ref:	PO-DEGERAETX	**ESA Quote #:**	PL2254_q01

Lab ID No.:	**Sample Name:**	**Sample Description:**
11676	Discharge Water	Aqueous sample, pH 8.1, conductivity 174µS/cm, total ammonia <2.0mg/L. Sample received at 14ºC in apparent good condition.

Test Performed:	72-hr microalgal growth inhibition test using the green alga *Chlorella sp.*
Test Protocol:	ESA SOP 103 (ESA 2016), based on USEPA (2002)
Test Temperature:	The test was performed at 29±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was filtered to 0.45µm and serially diluted with HDMW (Hard Dilute Mineral Water) with added USEPA nutrients media. A USEPA control was tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture, originally sourced from ERISS, NT
Test Initiated:	16 August 2024 at 1630h

Sample 11676: *Discharge Water* **Concentration (%)**	**Cell Yield x10^4 cells/mL (Mean ± SD)**	*Vacant*	Vacant
USEPA Control	68.2 ± 2.1		
6.3	67.4 ± 2.6		
12.5	68.6 ± 2.4		
25	68.6 ± 1.8		
50	68.3 ± 2.0		
100	69.1 ± 1.8		
72-hr IC10 = >100% **72-hr IC50 =>100%** **NOEC = 100%** **LOEC = >100%**			

QA/QC Parameter	**Criterion**	**This Test**	**Criterion met?**
Control mean cell density	≥16.0x10^4 cells/mL	69.2x10^4 cells/mL	Yes
Control coefficient of variation	<20%	3.1%	Yes
Reference Toxicant within cusum chart limits	0.3-10.9g KCl/L	1.5g KCl/L	Yes

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Toxicity Test Report: TR2254/5

Test Report Authorised by: Dr Rick Krassoi, Director on 5 September 2024

Results are based on the samples in the condition as received by ESA.

Citations:

ESA (2016) *ESA SOP 103 – Green Alga, Selenastrum capricornutum, Growth Test*. Issue No 11. Ecotox Services Australasia, Sydney, NSW.

USEPA (2002) *Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms*. Fourth Edition. EPA-821-R-02-013. United States Environmental Protection Agency, Office of Research and Development, Washington DC, USA,

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Chain-of-Custody Documentation

Datasheet ID: 601.2
Last Revised: 21 September 2018

Sample Receipt Notification

Attention : Elliott Duncan

Client : MBS Environmental
4 Cook St
West Perth WA 6005

Email : eduncan@mbsenvironmental
Telephone : 08 9226 3166
Facsimile :

Date : 16/08/2024

Re : Receipt of Samples **Pages : 2**

ESA Project : PR2254 ☑ For Review ☐ Additional Documentation Required - Please Respond

Sample Delivery Details

Completed Chain of Custody accompanied samples: YES
Samples received in apparent good condition and correctly bottled: YES
Security seals on sample bottles and esky intact: YES

Date samples received : 14/08/2024
Time samples received : 13:30
No. of samples received : 1
Sample matrix : Aqueous
Sample temperature : 11-15°C

Comments : 2 x 20L (containing approx 17L each) sample received at 14 degrees C in apparent good condition

Contact Details

Projects Manager : Dr Rick Krassoi
Telephone : 61 2 9420 9481
Facsimile : 61 2 9420 9484
Email : rkrassoi@ecotox.com.au

Please contact customer services officer for all queries or issues regarding samples

Note that the chain-of-custody provides definitive information on the tests to be performed

Chain-of-Custody / Service Request Form

ecotox SERVICES AUSTRALIA

Datasheet ID: 601.1
Last Revised: 14 December 2022

Customer: MBS Environmental
Contact Name: Elliott Duncan
Phone: 0431617821 Email: eduncan@mbsenvironmental.com.au (please provide an email address for sample receipt notification)
Purchase Order: DEGERAETX

Ship To: Ecotox Services Australia - Unit 27, 2 Chaplin Drive, Lane Cove West, NSW, 2066
Attention: Dr Rick Krassoi

Sample Date (day/month /year)	Sample Time	Sample Name (exactly as written on the sample vessel)	Sample Method (eg. Grab, composite etc.)	Number and Volume of Containers (eg 2 x 1L)	Tests Requested (See reverse for guidance)						Comments / Instructions
	14°C.				As per PL2554-01						**Note that testing will be delayed if an incomplete chain of custody is received** • Additional treatment of samples (i.e. spiking) • Sub-contracted services (i.e. chemical analyses) • Dilutions required (if different than 100% down to 6.25%) • Sample holding time restriction (if applicable) • Sample used for litigation (if applicable) *Note: An MSDS must be attached if Available* **ESA Project Number: PR** 2554
11/08/2024	9:30	Discharge Water	N/A	2 x 17L	✓						Please Conduct as per quote - PL02554 Please see attached experimental instructions HDMW AS DILUENT Test Concs 100, 60, 40, 20 + 2%

11676

1) Released By:	Date:	2) Received By:	Date:	3) Released By:	Date:	4) Received By:	Date:
Liam Fell	12/08/2024		14/8/24				
Of:	Time:	Of: ESA	Time: 1330	Of:	Time:	Of:	Time:

Note that the chain-of-custody documentation will provide definitive information on the tests to be performed.

Ecotox Services Australia . Unit 27, 2 Chaplin Drive, Lane Cove NSW 2066 AUSTRALIA
Phone: 61 2 9420-9481 Email: info@ecotox.com.au

Sub-contracted Chemical Analyses

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 360539

Client Details

Client	Ecotox Services Australia Pty Ltd
Attention	Mr Rick Krassoi
Address	Unit 27, 2 Chaplin Dr, Lane Cove, NSW, 2066

Sample Details

Your Reference	**PR2254**
Number of Samples	6 Water
Date samples received	30/08/2024
Date completed instructions received	30/08/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	06/09/2024
Date of Issue	06/09/2024

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Giovanni Agosti, Group Technical Manager
Nick Sarlamis, Assistant Operation Manager

Authorised By
Nancy Zhang, Laboratory Manager

Ion Balance						
Our Reference		360539-1	360539-2	360539-3	360539-4	360539-5
Your Reference	UNITS	HDMW	2%	20%	40%	60%
Date Sampled		16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Date analysed	-	30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Calcium - Dissolved	mg/L	68	64	58	52	47
Potassium - Dissolved	mg/L	1	5	3	5	6.4
Sodium - Dissolved	mg/L	5.0	9.3	43	78	120
Magnesium - Dissolved	mg/L	2	2	9.6	18	26
Hardness (calc) equivalent $CaCO_3$	mg/L	180	170	180	200	220
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	160	170	210	250	300
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	160	170	210	250	300
Sulphate, SO4	mg/L	10	11	20	30	38
Chloride, Cl	mg/L	9	17	48	87	120
Ionic Balance	%	1.0	-2.0	-3.0	-3.0	-2.0

Ion Balance		
Our Reference		360539-6
Your Reference	UNITS	100%
Date Sampled		16/08/2024
Type of sample		Water
Date prepared	-	30/08/2024
Date analysed	-	30/08/2024
Calcium - Dissolved	mg/L	34
Potassium - Dissolved	mg/L	10
Sodium - Dissolved	mg/L	210
Magnesium - Dissolved	mg/L	43
Hardness (calc) equivalent $CaCO_3$	mg/L	260
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	360
Carbonate Alkalinity as $CaCO_3$	mg/L	24
Total Alkalinity as $CaCO_3$	mg/L	380
Sulphate, SO4	mg/L	56
Chloride, Cl	mg/L	200
Ionic Balance	%	2.0

All metals in water-dissolved						
Our Reference		360539-1	360539-2	360539-3	360539-4	360539-5
Your Reference	UNITS	HDMW	2%	20%	40%	60%
Date Sampled		16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/09/2024	04/09/2024	04/09/2024	04/09/2024	04/09/2024
Date analysed	-	04/09/2024	04/09/2024	04/09/2024	04/09/2024	04/09/2024
Arsenic-Dissolved	µg/L	<1	<1	<1	<1	<1
Uranium-Dissolved	µg/L	0.6	1.3	7.3	14	20
Vanadium-Dissolved	µg/L	<1	<1	1	2	3

All metals in water-dissolved		
Our Reference		360539-6
Your Reference	UNITS	100%
Date Sampled		16/08/2024
Type of sample		Water
Date prepared	-	04/09/2024
Date analysed	-	04/09/2024
Arsenic-Dissolved	µg/L	2
Uranium-Dissolved	µg/L	33
Vanadium-Dissolved	µg/L	5

Miscellaneous Inorganics						
Our Reference		360539-1	360539-2	360539-3	360539-4	360539-5
Your Reference	UNITS	HDMW	2%	20%	40%	60%
Date Sampled		16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Total Dissolved Solids (grav)	mg/L	260	350	390	550	530

Miscellaneous Inorganics		
Our Reference		360539-6
Your Reference	UNITS	100%
Date Sampled		16/08/2024
Type of sample		Water
Date prepared	-	03/09/2024
Date analysed	-	03/09/2024
Total Dissolved Solids (grav)	mg/L	860

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:- TDS = EC * 0.6
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			30/08/2024	5	30/08/2024	30/08/2024		30/08/2024	[NT]
Date analysed	-			30/08/2024	5	30/08/2024	30/08/2024		30/08/2024	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	47	[NT]		98	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	6.4	[NT]		91	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	120	[NT]		99	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	26	[NT]		93	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	5	220	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	5	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	5	300	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	5	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	5	300	[NT]		110	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	5	38	38	0	107	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	5	120	120	0	101	[NT]
Ionic Balance	%		Inorg-040	[NT]	5	-2.0	[NT]		[NT]	[NT]

QUALITY CONTROL: All metals in water-dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			04/09/2024	[NT]	[NT]	[NT]	[NT]	04/09/2024	[NT]
Date analysed	-			04/09/2024	[NT]	[NT]	[NT]	[NT]	04/09/2024	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Uranium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			03/09/2024	[NT]	[NT]	[NT]	[NT]	03/09/2024	[NT]
Date analysed	-			03/09/2024	[NT]	[NT]	[NT]	[NT]	03/09/2024	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Statistical Printouts for the 3-brood Partial Life Cycle Test with *Ceriodaphnia dubia*

Ceriodaphnia Partial Life-Cycle Test-Reproduction

Start Date:	16/08/2024 18:30	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	23/08/2024 18:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 102	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4	5	6	7	8	9	10
DMW Control	0.000	17.000	16.000	14.000	17.000	15.000	16.000	15.000	16.000	16.000
HDMW Control	16.000	18.000	16.000	17.000	13.000	15.000	16.000	15.000	16.000	0.000
2	16.000	15.000	15.000	17.000	13.000	21.000	16.000	17.000	16.000	16.000
20	12.000	15.000	15.000	16.000	13.000	16.000	15.000	16.000	15.000	
40	15.000	15.000	17.000	15.000	17.000	16.000	18.000	15.000	16.000	
60	17.000	14.000	12.000	16.000	16.000	16.000	18.000	0.000	15.000	16.000
100	14.000	18.000	18.000	17.000	17.000	19.000	16.000	15.000	15.000	

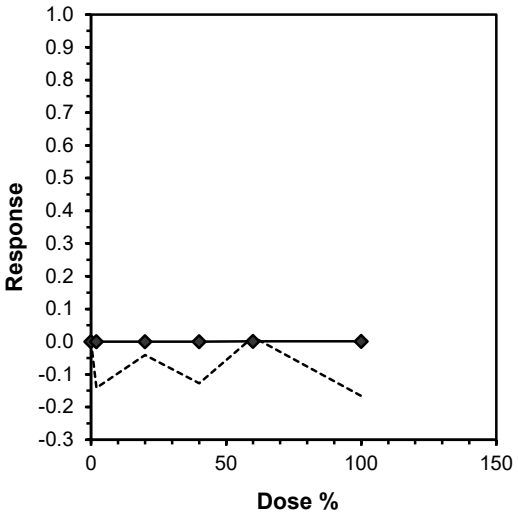
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
DMW Control	14.200	1.0000	14.200	0.000	17.000	35.724	10				
HDMW Control	14.200	1.0000	14.200	0.000	18.000	36.336	10	*		15.294	1.0000
2	16.200	1.1408	16.200	13.000	21.000	12.617	10	113.50	74.00	15.294	1.0000
20	14.778	1.0407	14.778	12.000	16.000	9.436	9	77.50	61.00	15.294	1.0000
40	16.000	1.1268	16.000	15.000	18.000	6.988	9	95.50	61.00	15.294	1.0000
60	14.000	0.9859	14.000	0.000	18.000	37.039	10	103.50	74.00	15.278	0.9989
100	16.556	1.1659	16.556	14.000	19.000	10.067	9	105.00	61.00	15.278	0.9989

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.05)	1.49332	0.895	-3.06506	12.47035
Bartlett's Test indicates unequal variances (p = 2.42E-06)	33.96634	15.08627		
The control means are not significantly different (p = 1.00)	0	2.100922		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Wilcoxon Rank Sum Test Treatments vs HDMW Control	100	>100		1

Linear Interpolation (200 Resamples)

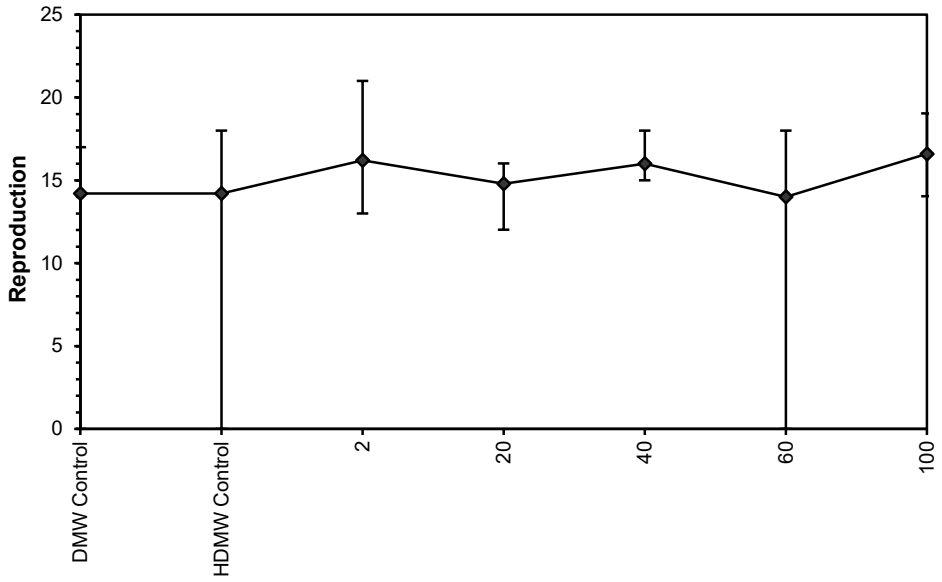
Point	%	SD	95% CL	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Ceriodaphnia Partial Life-Cycle Test-Reproduction

Start Date:	16/08/2024 18:30	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	23/08/2024 18:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 102	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Ceriodaphnia Partial Life-Cycle Test-Reproduction

Start Date:	16/08/2024 18:30	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	23/08/2024 18:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 102	Test Species:	CD-Ceriodaphnia dubia
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
DMW Control	No of Young	14.20	0.00	17.00	5.07	15.86	10
HDMW Control		14.20	0.00	18.00	5.16	16.00	10
2		16.20	13.00	21.00	2.04	8.83	10
20		14.78	12.00	16.00	1.39	7.99	9
40		16.00	15.00	18.00	1.12	6.61	9
60		14.00	0.00	18.00	5.19	16.27	10
100		16.56	14.00	19.00	1.67	7.80	9
DMW Control	% unaffected	90.00	0.00	100.00	31.62	6.25	10
HDMW Control		90.00	0.00	100.00	31.62	6.25	10
2		100.00	100.00	100.00	0.00	0.00	10
20		100.00	100.00	100.00	0.00	0.00	9
40		100.00	100.00	100.00	0.00	0.00	10
60		90.00	0.00	100.00	31.62	6.25	10
100		100.00	100.00	100.00	0.00	0.00	9
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
HDMW Control		8.10	8.10	8.10	0.00	0.00	1
2		8.10	8.10	8.10	0.00	0.00	1
20		8.10	8.10	8.10	0.00	0.00	1
40		8.10	8.10	8.10	0.00	0.00	1
60		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
DMW Control	DO %	99.80	99.80	99.80	0.00	0.00	1
HDMW Control		101.80	101.80	101.80	0.00	0.00	1
2		100.70	100.70	100.70	0.00	0.00	1
20		100.50	100.50	100.50	0.00	0.00	1
40		100.30	100.30	100.30	0.00	0.00	1
60		100.20	100.20	100.20	0.00	0.00	1
100		100.20	100.20	100.20	0.00	0.00	1
DMW Control	Cond uS/cm	174.00	174.00	174.00	0.00	0.00	1
HDMW Control		340.00	340.00	340.00	0.00	0.00	1
2		378.00	378.00	378.00	0.00	0.00	1
20		561.00	561.00	561.00	0.00	0.00	1
40		780.00	780.00	780.00	0.00	0.00	1
60		995.00	995.00	995.00	0.00	0.00	1
100		1426.00	1426.00	1426.00	0.00	0.00	1

Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

Start Date:	16/08/2024 18:30	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	23/08/2024 18:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 102	Test Species:	CD-Ceriodaphnia dubia
Comments:					

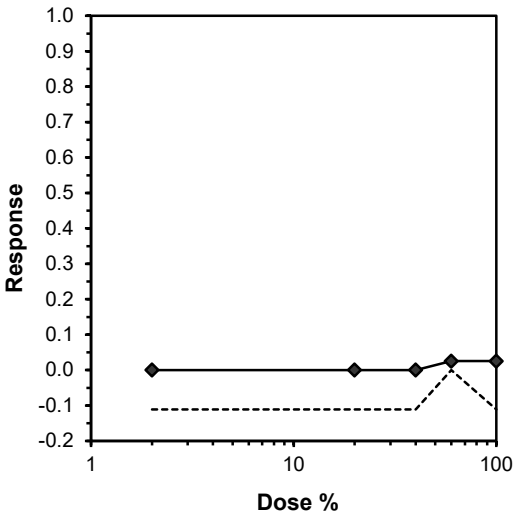
Conc-%	1	2	3	4	5	6	7	8	9	10
DMW Control	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
HDMW Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
20	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
40	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical	Isotonic Mean	Isotonic N-Mean
DMW Control	0.9000	1.0000	1	9	10	10	0.6271			
HDMW Control	0.9000	1.0000	1	9	10	10	*		0.9750	1.0000
2	1.0000	1.1111	0	10	10	10	0.5000	0.0500	0.9750	1.0000
20	1.0000	1.1111	0	9	9	9	0.5263	0.0500	0.9750	1.0000
40	1.0000	1.1111	0	10	10	10	0.5000	0.0500	0.9750	1.0000
60	0.9000	1.0000	1	9	10	10	0.7632	0.0500	0.9500	0.9744
100	1.0000	1.1111	0	9	9	9	0.5263	0.0500	0.9500	0.9744

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Fisher's Exact Test	100	>100		1
Treatments vs HDMW Control				

Log-Logit Interpolation (200 Resamples)

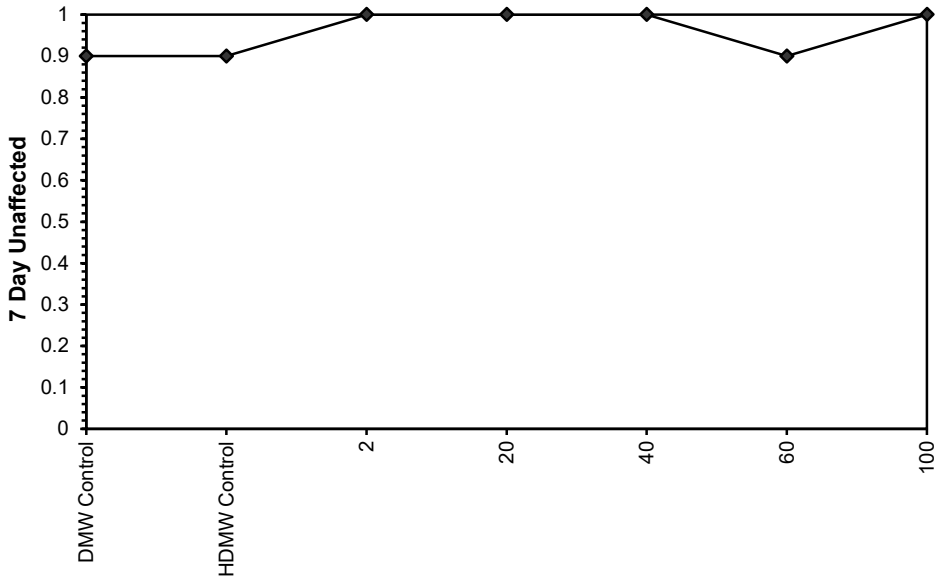
Point	%	SD	95% CL	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

Start Date:	16/08/2024 18:30	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	23/08/2024 18:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 102	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

Start Date:	16/08/2024 18:30	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	23/08/2024 18:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 102	Test Species:	CD-Ceriodaphnia dubia
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
DMW Control	No of Young	14.20	0.00	17.00	5.07	15.86	10
HDMW Control		14.20	0.00	18.00	5.16	16.00	10
2		16.20	13.00	21.00	2.04	8.83	10
20		14.78	12.00	16.00	1.39	7.99	9
40		16.00	15.00	18.00	1.12	6.61	9
60		14.00	0.00	18.00	5.19	16.27	10
100		16.56	14.00	19.00	1.67	7.80	9
DMW Control	% unaffected	90.00	0.00	100.00	31.62	6.25	10
HDMW Control		90.00	0.00	100.00	31.62	6.25	10
2		100.00	100.00	100.00	0.00	0.00	10
20		100.00	100.00	100.00	0.00	0.00	9
40		100.00	100.00	100.00	0.00	0.00	10
60		90.00	0.00	100.00	31.62	6.25	10
100		100.00	100.00	100.00	0.00	0.00	9
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
HDMW Control		8.10	8.10	8.10	0.00	0.00	1
2		8.10	8.10	8.10	0.00	0.00	1
20		8.10	8.10	8.10	0.00	0.00	1
40		8.10	8.10	8.10	0.00	0.00	1
60		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
DMW Control	DO %	99.80	99.80	99.80	0.00	0.00	1
HDMW Control		101.80	101.80	101.80	0.00	0.00	1
2		100.70	100.70	100.70	0.00	0.00	1
20		100.50	100.50	100.50	0.00	0.00	1
40		100.30	100.30	100.30	0.00	0.00	1
60		100.20	100.20	100.20	0.00	0.00	1
100		100.20	100.20	100.20	0.00	0.00	1
DMW Control	Cond uS/cm	174.00	174.00	174.00	0.00	0.00	1
HDMW Control		340.00	340.00	340.00	0.00	0.00	1
2		378.00	378.00	378.00	0.00	0.00	1
20		561.00	561.00	561.00	0.00	0.00	1
40		780.00	780.00	780.00	0.00	0.00	1
60		995.00	995.00	995.00	0.00	0.00	1
100		1426.00	1426.00	1426.00	0.00	0.00	1

Statistical Printouts for the Rainbowfish Embryonic Development and Post-hatch Survival Tests

Fish Embryonic Development-% Unaffected

Start Date:	16/08/2024 19:00	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	28/08/2024 19:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 126	Test Species:	MS-Melanotaenia splendida
Comments:					

Conc-%	1	2	3	4
DMW Control	1.0000	0.8000	0.8000	1.0000
HDMW Control	0.8000	0.8000	1.0000	0.8000
2	1.0000	0.8000	0.8000	1.0000
20	1.0000	0.8000	0.8000	0.8000
40	0.8000	0.8000	1.0000	1.0000
60	0.6000	1.0000	1.0000	1.0000
100	0.8000	1.0000	0.8000	1.0000

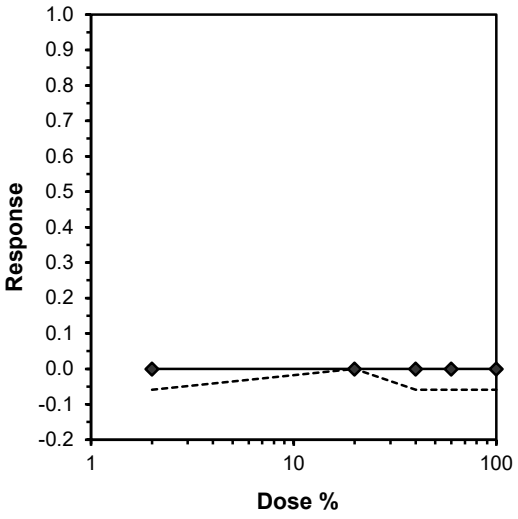
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
DMW Control	0.9000	1.0588	1.2262	1.1071	1.3453	11.212	4				
HDMW Control	0.8500	1.0000	1.1667	1.1071	1.3453	10.206	4	*		0.8833	1.0000
2	0.9000	1.0588	1.2262	1.1071	1.3453	11.212	4	20.00	10.00	0.8833	1.0000
20	0.8500	1.0000	1.1667	1.1071	1.3453	10.206	4	18.00	10.00	0.8833	1.0000
40	0.9000	1.0588	1.2262	1.1071	1.3453	11.212	4	20.00	10.00	0.8833	1.0000
60	0.9000	1.0588	1.2305	0.8861	1.3453	18.660	4	20.50	10.00	0.8833	1.0000
100	0.9000	1.0588	1.2262	1.1071	1.3453	11.212	4	20.00	10.00	0.8833	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.853355	0.916	-0.51551	-0.09352
Bartlett's Test indicates equal variances (p = 0.86)	1.904893	15.08627		
The control means are not significantly different (p = 0.54)	0.654654	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test Treatments vs HDMW Control	100	>100		1

Log-Logit Interpolation (200 Resamples)

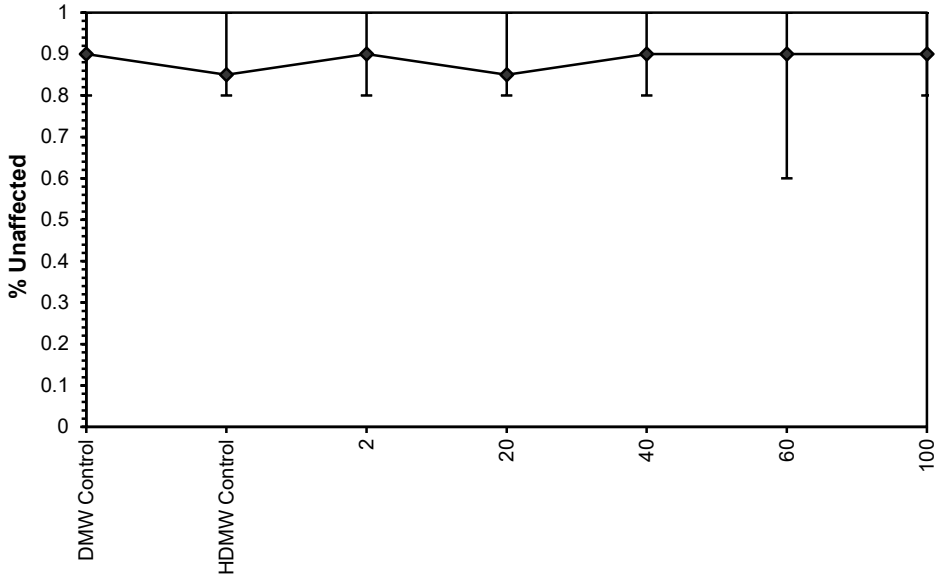
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Fish Embryonic Development-% Unaffected

Start Date:	16/08/2024 19:00	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	28/08/2024 19:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 126	Test Species:	MS-Melanotaenia splendida
Comments:					

Dose-Response Plot



Fish Embryonic Development-% Unaffected

Start Date:	16/08/2024 19:00	Test ID:	PR2254/02	Sample ID:	Discharge Water
End Date:	28/08/2024 19:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 126	Test Species:	MS-Melanotaenia splendida
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
DMW Control	% Unaffected	90.00	80.00	100.00	11.55	3.78	4
HDMW Control		85.00	80.00	100.00	10.00	3.72	4
2		90.00	80.00	100.00	11.55	3.78	4
20		85.00	80.00	100.00	10.00	3.72	4
40		90.00	80.00	100.00	11.55	3.78	4
60		90.00	60.00	100.00	20.00	4.97	4
100		90.00	80.00	100.00	11.55	3.78	4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
HDMW Control		8.10	8.10	8.10	0.00	0.00	1
2		8.10	8.10	8.10	0.00	0.00	1
20		8.10	8.10	8.10	0.00	0.00	1
40		8.10	8.10	8.10	0.00	0.00	1
60		8.10	8.10	8.10	0.00	0.00	1
100		54.05	8.10	100.00	64.98	14.91	2
DMW Control	Conductivity (uS/cm)	99.80	99.80	99.80	0.00	0.00	1
HDMW Control		101.80	101.80	101.80	0.00	0.00	1
2		100.70	100.70	100.70	0.00	0.00	1
20		100.50	100.50	100.50	0.00	0.00	1
40		100.30	100.30	100.30	0.00	0.00	1
60		100.20	100.20	100.20	0.00	0.00	1
100		100.20	100.20	100.20	0.00	0.00	1
DMW Control	DO (% sat)	174.00	174.00	174.00	0.00	0.00	1
HDMW Control		340.00	340.00	340.00	0.00	0.00	1
2		378.00	378.00	378.00	0.00	0.00	1
20		561.00	561.00	561.00	0.00	0.00	1
40		780.00	780.00	780.00	0.00	0.00	1
60		995.00	995.00	995.00	0.00	0.00	1
100		1426.00	1426.00	1426.00	0.00	0.00	1

Statistical Printouts for *Hydra* Population Growth Tests

Hydra Population Growth Test-Growth Rate

Start Date:	16/08/2024 20:00	Test ID:	PR2254/05	Sample ID:	Discharge Water
End Date:	20/08/2024 20:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 125	Test Species:	HV-Hydra viridissima
Comments:					

Conc-%	1	2	3	4
Lab Control	0.3059	0.2829	0.2985	0.3202
HDMW Control	0.3059	0.2747	0.2985	0.2747
2	0.2829	0.2985	0.2747	0.2908
20	0.3132	0.2829	0.3202	0.2662
40	0.2747	0.2829	0.3132	0.2908
60	0.3271	0.2829	0.3059	0.2985
100	0.2908	0.3202	0.2829	0.2985

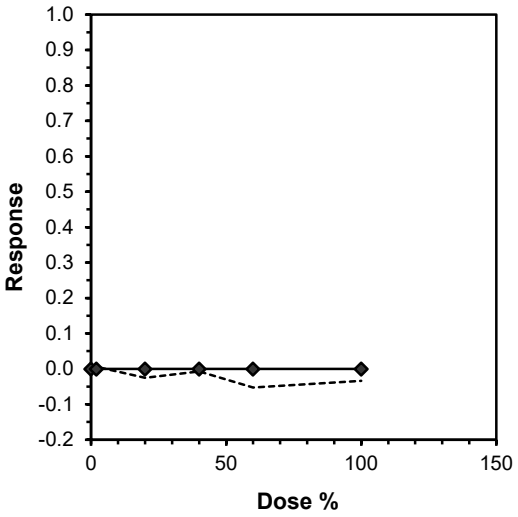
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Lab Control	0.3019	1.0466	0.3019	0.2829	0.3202	5.157	4					
HDMW Control	0.2884	1.0000	0.2884	0.2747	0.3059	5.617	4	*			0.2938	1.0000
2	0.2867	0.9940	0.2867	0.2747	0.2985	3.577	4	0.139	2.410	0.0302	0.2938	1.0000
20	0.2956	1.0249	0.2956	0.2662	0.3202	8.612	4	-0.573	2.410	0.0302	0.2938	1.0000
40	0.2904	1.0067	0.2904	0.2747	0.3132	5.709	4	-0.155	2.410	0.0302	0.2938	1.0000
60	0.3036	1.0525	0.3036	0.2829	0.3271	6.055	4	-1.209	2.410	0.0302	0.2938	1.0000
100	0.2981	1.0335	0.2981	0.2829	0.3202	5.396	4	-0.770	2.410	0.0302	0.2938	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.944832	0.916	0.150625	-1.03046
Bartlett's Test indicates equal variances (p = 0.83)	2.157439	15.08627		
The control means are not significantly different (p = 0.28)	1.196779	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs HDMW Control	100	>100		1	0.030223	0.104782	0.000167	0.000315	0.750363	5, 18

Linear Interpolation (200 Resamples)

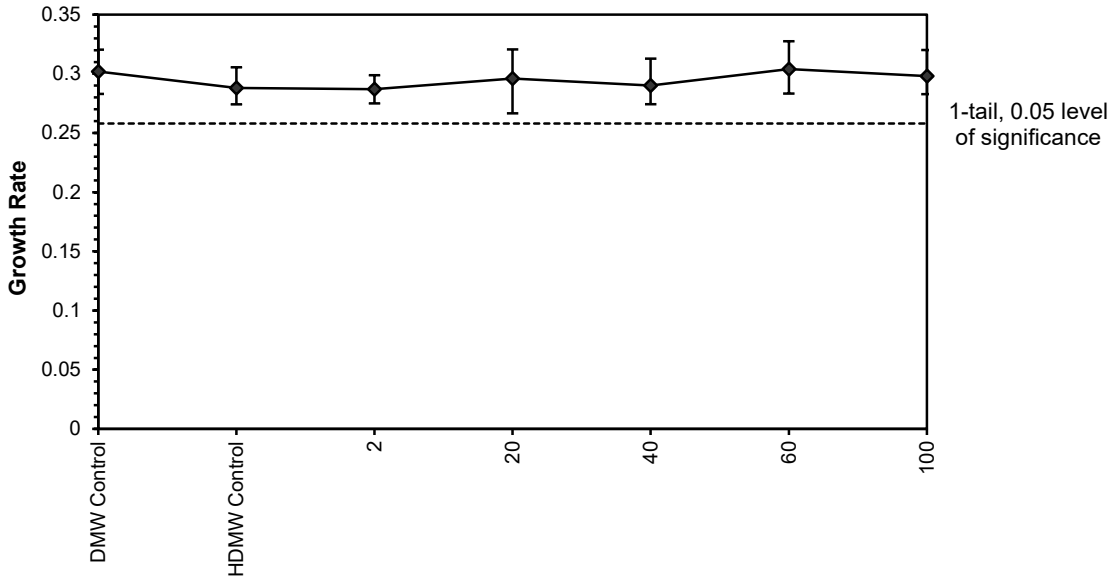
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Hydra Population Growth Test-Growth Rate

Start Date:	16/08/2024 20:00	Test ID:	PR2254/05	Sample ID:	Discharge Water
End Date:	20/08/2024 20:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 125	Test Species:	HV-Hydra viridissima
Comments:					

Dose-Response Plot



Hydra Population Growth Test-Growth Rate

Start Date:	16/08/2024 20:00	Test ID:	PR2254/05	Sample ID:	Discharge Water
End Date:	20/08/2024 20:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 125	Test Species:	HV-Hydra viridissima
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
Lab Control	Growth Rate	0.30	0.28	0.32	0.02	41.33	4
HDMW Control		0.29	0.27	0.31	0.02	44.13	4
2		0.29	0.27	0.30	0.01	35.32	4
20		0.30	0.27	0.32	0.03	53.98	4
40		0.29	0.27	0.31	0.02	44.34	4
60		0.30	0.28	0.33	0.02	44.66	4
100		0.30	0.28	0.32	0.02	42.54	4
Lab Control	Conductivity	174.00	174.00	174.00	0.00	0.00	1
HDMW Control		340.00	340.00	340.00	0.00	0.00	1
2		378.00	378.00	378.00	0.00	0.00	1
20		561.00	561.00	561.00	0.00	0.00	1
40		780.00	780.00	780.00	0.00	0.00	1
60		995.00	995.00	995.00	0.00	0.00	1
100		1426.00	1426.00	1426.00	0.00	0.00	1
Lab Control	pH	8.10	8.10	8.10	0.00	0.00	1
HDMW Control		8.10	8.10	8.10	0.00	0.00	1
2		8.10	8.10	8.10	0.00	0.00	1
20		8.10	8.10	8.10	0.00	0.00	1
40		8.10	8.10	8.10	0.00	0.00	1
60		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
Lab Control	DO, % sat	99.80	99.80	99.80	0.00	0.00	1
HDMW Control		101.80	101.80	101.80	0.00	0.00	1
2		100.70	100.70	100.70	0.00	0.00	1
20		100.50	100.50	100.50	0.00	0.00	1
40		100.30	100.30	100.30	0.00	0.00	1
60		100.20	100.20	100.20	0.00	0.00	1
100		100.20	100.20	100.20	0.00	0.00	1

Statistical Printouts for the Duckweed Growth Inhibition Tests

Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	16/08/2024 18:00	Test ID:	PR2254/06	Sample ID:	Discharge Water
End Date:	20/08/2024 18:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 112	Test Species:	LA-Lemna aequinoctialis
Comments:					

Conc-%	1	2	3	4
CAAC Control	0.3568	0.3666	0.3359	0.3760
2	0.3466	0.3760	0.3666	0.3359
20	0.3568	0.3851	0.4024	0.3666
40	0.3466	0.3359	0.3568	0.3359
60	0.3666	0.3760	0.3939	0.4024
100	0.4024	0.3851	0.3568	0.3666

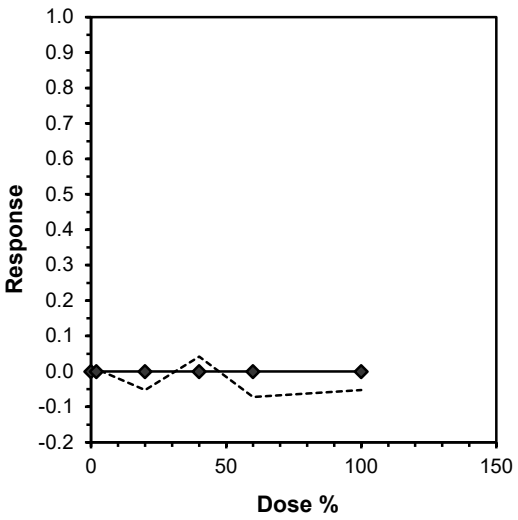
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
CAAC Control	0.3588	1.0000	0.3588	0.3359	0.3760	4.784	4				0.3665	1.0000
2	0.3563	0.9929	0.3563	0.3359	0.3760	5.135	4	0.208	2.410	0.0296	0.3665	1.0000
20	0.3777	1.0526	0.3777	0.3568	0.4024	5.348	4	-1.536	2.410	0.0296	0.3665	1.0000
40	0.3438	0.9581	0.3438	0.3359	0.3568	2.908	4	1.223	2.410	0.0296	0.3665	1.0000
60	0.3847	1.0721	0.3847	0.3666	0.4024	4.244	4	-2.106	2.410	0.0296	0.3665	1.0000
100	0.3777	1.0526	0.3777	0.3568	0.4024	5.348	4	-1.536	2.410	0.0296	0.3665	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.932987	0.916	0.046419	-1.29042
Bartlett's Test indicates equal variances (p = 0.92)	1.461379	15.08627		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs CAAC Control	100	>100		1	0.029615	0.082533	0.001009	0.000302	0.026156	5, 18

Linear Interpolation (200 Resamples)

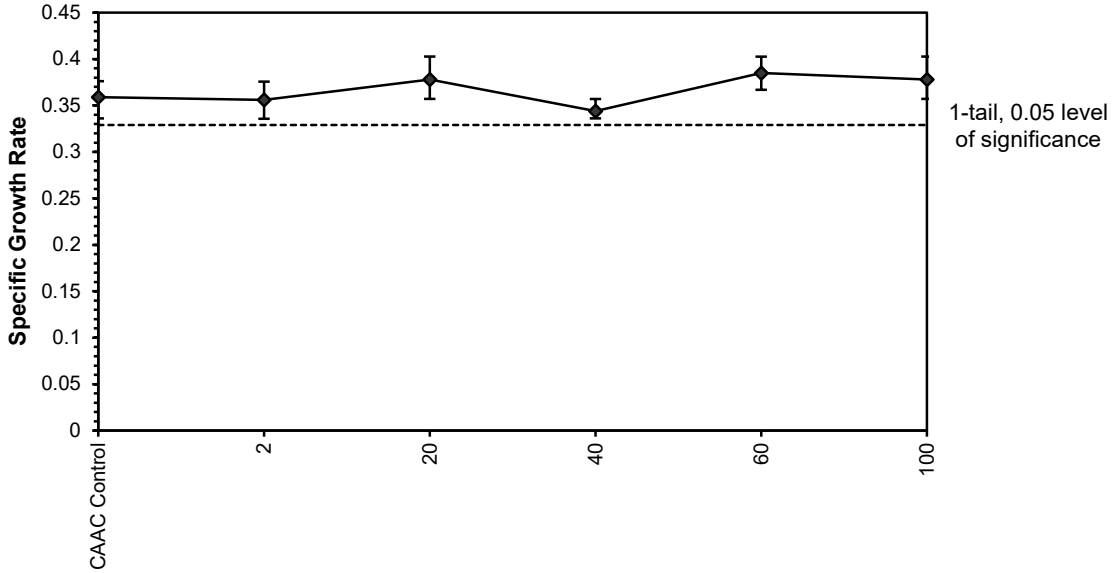
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	16/08/2024 18:00	Test ID:	PR2254/06	Sample ID:	Discharge Water
End Date:	20/08/2024 18:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 112	Test Species:	LA-Lemna aequinoctialis
Comments:					

Dose-Response Plot



Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	16/08/2024 18:00	Test ID:	PR2254/06	Sample ID:	Discharge Water
End Date:	20/08/2024 18:00	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 112	Test Species:	LA-Lemna aequinoctialis
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
CAAC Control	Specific growth rate	0.36	0.34	0.38	0.02	36.51	4
2		0.36	0.34	0.38	0.02	37.96	4
20		0.38	0.36	0.40	0.02	37.63	4
40		0.34	0.34	0.36	0.01	29.08	4
60		0.38	0.37	0.40	0.02	33.21	4
100		0.38	0.36	0.40	0.02	37.63	4
CAAC Control	pH	8.10	8.10	8.10	0.00	0.00	1
2		8.10	8.10	8.10	0.00	0.00	1
20		8.10	8.10	8.10	0.00	0.00	1
40		8.10	8.10	8.10	0.00	0.00	1
60		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
CAAC Control	Cond uS/cm	174.00	174.00	174.00	0.00	0.00	1
2		378.00	378.00	378.00	0.00	0.00	1
20		561.00	561.00	561.00	0.00	0.00	1
40		780.00	780.00	780.00	0.00	0.00	1
60		995.00	995.00	995.00	0.00	0.00	1
100		1426.00	1426.00	1426.00	0.00	0.00	1

Statistical Printouts for the *Chlorella* Growth Inhibition Tests

Microalgal Cell Yield-Cell Yield

Start Date:	16/08/2024 16:30	Test ID:	PR2254/09	Sample ID:	Discharge Water
End Date:	19/08/2024 16:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 110	Test Species:	CV-Chlorella vulgaris
Comments:					

Conc-%	1	2	3	4	5	6	7	8
USEPA Control	66.762	67.362	70.062	66.162	67.362	70.062	66.162	71.862
2	70.962	66.762	67.362	64.662				
20	71.862	67.362	66.462	68.562				
40	67.062	65.862	70.062	67.362				
60	66.762	68.862	70.962	66.762				
100	70.962	70.062	67.062	68.262				

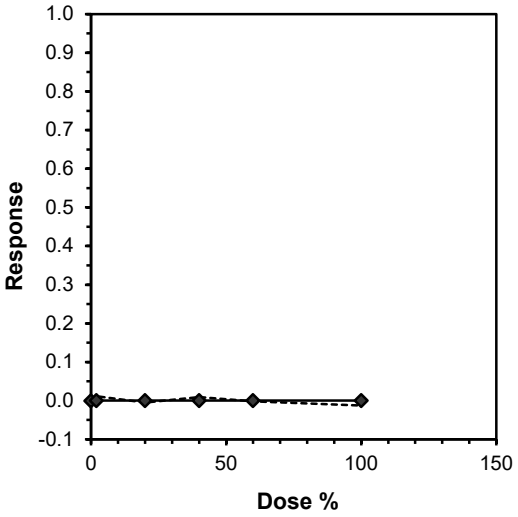
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
USEPA Control	68.224	1.0000	68.224	66.162	71.862	3.140	8			68.224	1.0000
2	67.437	0.9885	67.437	64.662	70.962	3.885	4	23.50	12.00	68.202	0.9997
20	68.562	1.0049	68.562	66.462	71.862	3.445	4	28.50	12.00	68.202	0.9997
40	67.587	0.9907	67.587	65.862	70.062	2.623	4	23.00	12.00	68.202	0.9997
60	68.337	1.0016	68.337	66.762	70.962	2.942	4	27.00	12.00	68.202	0.9997
100	69.087	1.0126	69.087	67.062	70.962	2.541	4	31.00	12.00	68.202	0.9997

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.9117	0.924	0.583115	-0.9125
Bartlett's Test indicates equal variances (p = 0.98)	0.681912	15.08627		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Wilcoxon Rank Sum Test Treatments vs USEPA Control	100	>100		1

Linear Interpolation (200 Resamples)

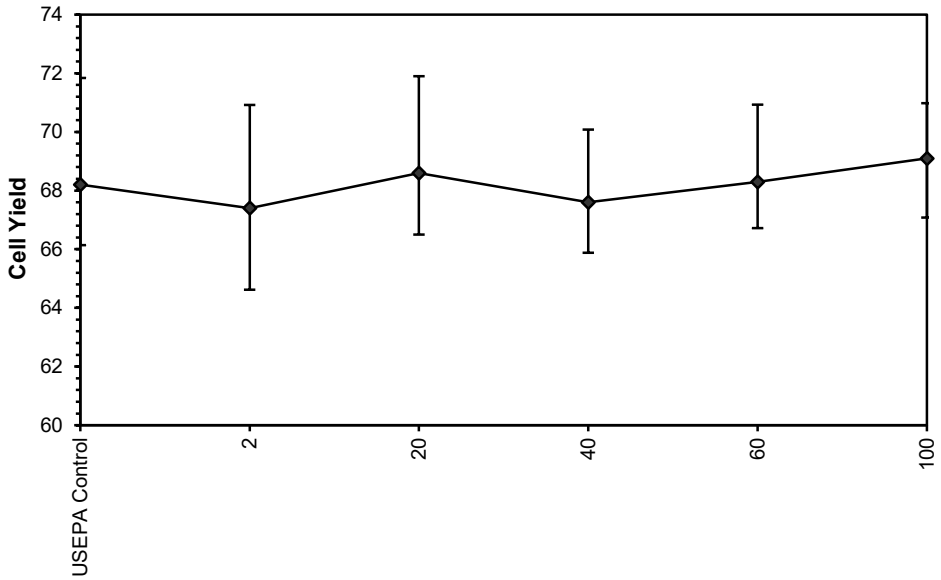
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Microalgal Cell Yield-Cell Yield

Start Date:	16/08/2024 16:30	Test ID:	PR2254/09	Sample ID:	Discharge Water
End Date:	19/08/2024 16:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 110	Test Species:	CV-Chlorella vulgaris
Comments:					

Dose-Response Plot



Microalgal Cell Yield-Cell Yield

Start Date:	16/08/2024 16:30	Test ID:	PR2254/09	Sample ID:	Discharge Water
End Date:	19/08/2024 16:30	Lab ID:	11676	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 110	Test Species:	CV-Chlorella vulgaris
Comments:					

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
USEPA Control	Cell Yield	68.22	66.16	71.86	2.14	2.15	8
2		67.44	64.66	70.96	2.62	2.40	4
20		68.56	66.46	71.86	2.36	2.24	4
40		67.59	65.86	70.06	1.77	1.97	4
60		68.34	66.76	70.96	2.01	2.07	4
100		69.09	67.06	70.96	1.76	1.92	4
USEPA Control	pH	8.10	8.10	8.10	0.00	0.00	1
2		8.10	8.10	8.10	0.00	0.00	1
20		8.10	8.10	8.10	0.00	0.00	1
40		8.10	8.10	8.10	0.00	0.00	1
60		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
USEPA Control	Conductivity uS/cm	174.00	174.00	174.00	0.00	0.00	1
2		378.00	378.00	378.00	0.00	0.00	1
20		561.00	561.00	561.00	0.00	0.00	1
40		780.00	780.00	780.00	0.00	0.00	1
60		995.00	995.00	995.00	0.00	0.00	1
100		1426.00	1426.00	1426.00	0.00	0.00	1

ATTACHMENT 2: ANALYSIS OF WATER AND DILUENT WATER

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 360539

Client Details

Client	Ecotox Services Australia Pty Ltd
Attention	Mr Rick Krassoi
Address	Unit 27, 2 Chaplin Dr, Lane Cove, NSW, 2066

Sample Details

Your Reference	**PR2254**
Number of Samples	6 Water
Date samples received	30/08/2024
Date completed instructions received	30/08/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	06/09/2024
Date of Issue	06/09/2024

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Giovanni Agosti, Group Technical Manager
Nick Sarlamis, Assistant Operation Manager

Authorised By
Nancy Zhang, Laboratory Manager

Ion Balance						
Our Reference		360539-1	360539-2	360539-3	360539-4	360539-5
Your Reference	UNITS	HDMW	2%	20%	40%	60%
Date Sampled		16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Date analysed	-	30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Calcium - Dissolved	mg/L	68	64	58	52	47
Potassium - Dissolved	mg/L	1	5	3	5	6.4
Sodium - Dissolved	mg/L	5.0	9.3	43	78	120
Magnesium - Dissolved	mg/L	2	2	9.6	18	26
Hardness (calc) equivalent $CaCO_3$	mg/L	180	170	180	200	220
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	160	170	210	250	300
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	160	170	210	250	300
Sulphate, SO4	mg/L	10	11	20	30	38
Chloride, Cl	mg/L	9	17	48	87	120
Ionic Balance	%	1.0	-2.0	-3.0	-3.0	-2.0

Ion Balance		
Our Reference		360539-6
Your Reference	UNITS	100%
Date Sampled		16/08/2024
Type of sample		Water
Date prepared	-	30/08/2024
Date analysed	-	30/08/2024
Calcium - Dissolved	mg/L	34
Potassium - Dissolved	mg/L	10
Sodium - Dissolved	mg/L	210
Magnesium - Dissolved	mg/L	43
Hardness (calc) equivalent $CaCO_3$	mg/L	260
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	360
Carbonate Alkalinity as $CaCO_3$	mg/L	24
Total Alkalinity as $CaCO_3$	mg/L	380
Sulphate, SO4	mg/L	56
Chloride, Cl	mg/L	200
Ionic Balance	%	2.0

All metals in water-dissolved						
Our Reference		360539-1	360539-2	360539-3	360539-4	360539-5
Your Reference	UNITS	HDMW	2%	20%	40%	60%
Date Sampled		16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/09/2024	04/09/2024	04/09/2024	04/09/2024	04/09/2024
Date analysed	-	04/09/2024	04/09/2024	04/09/2024	04/09/2024	04/09/2024
Arsenic-Dissolved	µg/L	<1	<1	<1	<1	<1
Uranium-Dissolved	µg/L	0.6	1.3	7.3	14	20
Vanadium-Dissolved	µg/L	<1	<1	1	2	3

All metals in water-dissolved		
Our Reference		360539-6
Your Reference	UNITS	100%
Date Sampled		16/08/2024
Type of sample		Water
Date prepared	-	04/09/2024
Date analysed	-	04/09/2024
Arsenic-Dissolved	µg/L	2
Uranium-Dissolved	µg/L	33
Vanadium-Dissolved	µg/L	5

Miscellaneous Inorganics						
Our Reference		360539-1	360539-2	360539-3	360539-4	360539-5
Your Reference	UNITS	HDMW	2%	20%	40%	60%
Date Sampled		16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Total Dissolved Solids (grav)	mg/L	260	350	390	550	530

Miscellaneous Inorganics		
Our Reference		360539-6
Your Reference	UNITS	100%
Date Sampled		16/08/2024
Type of sample		Water
Date prepared	-	03/09/2024
Date analysed	-	03/09/2024
Total Dissolved Solids (grav)	mg/L	860

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:- TDS = EC * 0.6
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			30/08/2024	5	30/08/2024	30/08/2024		30/08/2024	[NT]
Date analysed	-			30/08/2024	5	30/08/2024	30/08/2024		30/08/2024	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	47	[NT]		98	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	6.4	[NT]		91	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	120	[NT]		99	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	26	[NT]		93	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	5	220	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	5	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	5	300	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	5	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	5	300	[NT]		110	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	5	38	38	0	107	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	5	120	120	0	101	[NT]
Ionic Balance	%		Inorg-040	[NT]	5	-2.0	[NT]		[NT]	[NT]

QUALITY CONTROL: All metals in water-dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			04/09/2024	[NT]	[NT]	[NT]	[NT]	04/09/2024	[NT]
Date analysed	-			04/09/2024	[NT]	[NT]	[NT]	[NT]	04/09/2024	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Uranium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			03/09/2024	[NT]	[NT]	[NT]	[NT]	03/09/2024	[NT]
Date analysed	-			03/09/2024	[NT]	[NT]	[NT]	[NT]	03/09/2024	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

ATTACHMENT 3: TEIR 3 ERA TABLES

Risk Event / Pathway	Receptors	Potential Impacts	Key Considerations	Risk Assessment (Inherent)			Available Controls	Risk Assessment (Residual)			Other Comments
				Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
Release of metal(oids) into Turner River System	Aquatic biota	Death, reproduction inhibiton, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of living in a metal(oid) contaminated environment	U is likely to exceed ANZG (2018) freshwater species protection DGVs and/or Turner River site/regional specific guideline values in discharge water. Under most rainfall scenarios As ands V concentrations in Turner River post discharge will be at or below the Site specific guideline value. U concentrations, however, likely to be elevated at least within a 'zone of discharge' (approx. 50 km) unless rainfall is above average during the discharge period Rainfall (and the subsequent flow of water) within the Turner River catchment has a very strong effect on overall risk Ecotoxicology tests demonstrated no effects of discharge water on local biota	B - Likely	1 - Insignificant	7 - Low	Water can be treated via holding in soil-ponds to lower V, As and to a lesser extent U prior to discharge Surface water monitoring and ecological monitoring to measure contaminant concentrations in Turner River over time and assess ecological impacts post discharge	D - Unlikely	1 - Insignificant	2 - Very Low	Rainfall within the catchment during the discharge period is a major consideration in assessing risk.
	Terrestrial Organisms (inc livestock)	Death, reproduction inhibition, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of consuming Turner River water (post discharge) as a drinking water source	Discharge water and Turner River water pre- and post-discharge contain concentrations of contaminants well below the ANZECC (2000) livestock drinking water guidelines which are used to assess the risk to terrestrial fauna.	D - Unlikely	2 - Minor	5 - Very low	Water can be treated via holding in soil-ponds to lower V, As and to a lesser extent U concentrations prior to discharge	E - Rare	1- Insignificant	1 - Very low	Rainfall within the catchment during the discharge period is a major consideration in assessing risk.
	Floodplain Soils/Vegetation	Long-term contamination of soils, loss of vegetation, recolonisation by weed species if metal(oid) contaminated water overflows from the Turner River onto adjacent floodplains	Predicted U concentrations in Turner River water post-discharge exceed the ANZECC (2000) long-term irrigation guideline value of 10 µg/L, which suggests that plants may be susceptible if exposed, keeping in mind, however, that these guidelines are for crop rather than native species. Predicted V concentrations, however, are unlikely to exceed the long-term irrigation GV of 100 µg/L. Inundation of floodplain soils highly unlikely to occur even after extreme rainfall events as spatial modelling predicts that water is likely to be constrained to channels and/or anabranches. In any case high rainfall events will result in significant contaminant dilution, which will result in negligible U and V concentrations being deposited in terrestrial soils which is unlikely to have any ecological effect.	E - Rare	2 - Minor	3 - Very low	Water can be treated via holding in soil-ponds to remove V and As prior to discharge	E - Rare	1 - Insignificant	1 - Very low	Rainfall within the catchment during the discharge period is a major consideration in assessing risk.

Risk Event / Pathway	Receptors	Potential Impacts	Key Considerations	Risk Assessment (Inherent)			Available Controls	Risk Assessment (Residual)			Other Comments
				Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
Release of radionuclides into the Turner River System	Aquatic biota	Death, reproduction inhibition, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of exposure to radiological materials	U is the main element of concern in a radiological sense. As U is an alpha-emitter aquatic organisms are unlikely to be effected as the major risk for U is related to consumption via inhalation i.e. drinking water	D- Unlikely	3 - Moderate	9 - Low	Water can be treated via holding in soil-ponds to lower U concentrations prior to discharge	E - Rare	3 - Moderate	6 - Very Low	High rainfall within the catchment will lower the radiological dose received by organisms as a result of dilution effects
			ERICA Modelling suggests that population effects as a result of radionuclide exposure are unlikely for species residing within the Turner River - post discharge.				Surface water and ecological monitoring to establish levels of radionuclides within the Turner River system and any ecological effects				
	Terrestrial Organisms (Inc Livestock)	Death, reproduction inhibition, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of consuming Turner River water (post discharge) as a drinking water source	Radiological doses in the discharge water are likely to exceed the livestock drinking water quality value of 0.2 Bq/L, which will also be the case even if rainfall within the catchment is typical of median years (i.e. 5GL/year)	D- Unlikely	3 - Moderate	9 - Low	Water can be treated via holding in soil-ponds to lower U concentrations prior to discharge	E - Rare	3 - Moderate	6 - Very Low	High rainfall within the catchment will lower the radiological dose received by organisms as a result of dilution effects
							Surface water and ecological monitoring to establish levels of radionuclides within the Turner River system and any ecological effects				
							Discharge zone to not be located in close proximity to known habitats of protected faunal species or adjacent to pastoral stations				
							Alternative drinking water sources provided for livestock species				
			RESRAD-BIOTA modelling demonstrates that there are unlikely to be any population-level effects on fauna consuming water from the Turner River post discharge								
	Adjacent Soils/Vegetation	Long-term contamination of soils, loss of vegetation, recolonisation by weed species if radiologically contaminated water overflows from the Turner River onto adjacent floodplains	Radiological doses in the discharge water are likely to exceed the long-term irrigation water quality value of 0.2 Bq/L, which may effect some plant species, although the value is designed for crop species	D - Unlikely	2 - Minor	5 - Very Low	Water can be treated via holding in soil-ponds to lower U concentrations prior to discharge	E - Rare	2 - Minor	3 - Very Low	Extensive inundation of floodplain soils only remotely possible in high rainfall years - this would likely dilute U content in Turner River thus reducing radionuclide content.
			The accumulation in soils is also potentially deleterious for future plant growth, although U is unlikely to have deleterious effects on biota within the soil ecosystem (alpha emitter)				Levees could be constructed if areas are identified that would likely become inundated from the planned discharge in the absence of any rainfall				
			Inundation of floodplain soils highly unlikely to occur even after extreme rainfall events as spatial modelling predicts that water is likely to be constrained to channels and/or anabranches. In any case high rainfall events will result in significant contaminant dilution, which will result in negligible U concentrations being deposited in terrestrial soils which is unlikely to have any radiological effects.								

Risk Event / Pathway	Receptors	Potential Impacts	Key Considerations	Risk Assessment (Inherent)			Available Controls	Risk Assessment (Residual)			Other Comments
				Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
Accumulation of metal(oids) in Turner River Sediments	Sediment biota	Death, reproduction inhibition, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of the accumulation of contaminants in sediments	Background concentrations of contaminants of interest - As, U and V are low.	C - Possible	3 - Moderate	13 - Medium	Pre-treatment of water in soil ponds to lower concentrations of U, V and other contaminants prior to discharge.	D - Unlikely	2 - Minor	5 - Very Low	Rainfall likely to influence contaminant loads in the zone of discharge and across he river system as a whole
			Guidelines do not exist for U or V - makes interpretation of risks associated with accumulation difficult								
			Rainfall within the catchment again likely to dictate extent of contaminant accumulation - i.e. more water will result in contaminant dilution both in concentration and distance				Ecological monitoring to measure contaminant concentrations in Turner River over time and assess ecological impacts post discharge				
			V likely to become less bioavailable once adsorbed into sediment phases - lower toxicity								
			Fate and bioavailability of key contaminants (V and U) in sediments is uncertain								
	Aquatic biota	Death, reproduction inhibition, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of the recycling of contaminants from sediments to the water column upon disturbance	Although some remobilisation of contaminants from sediments to the water column is possible the majority will likely remain bound so sediment components thus reducing the content in the water column and decreasing the potential ecological risk	D - Unlikely	2 - Minor	5 - Very Low	Pre-treatment of water in soil ponds to lower concentrations of U, V and other contaminants prior to discharge.	E- Rare	2 - Minor	3 - Very Low	
			Ecotoxicology tests demonstrated limited toxicological effects of discharge water at differing dilution rates								

Risk Event / Pathway	Receptors	Potential Impacts	Key Considerations	Risk Assessment (Inherent)			Available Controls	Risk Assessment (Residual)			Other Comments
				Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
Accumulation of radionuclides in Turner River Sediments	Sediment biota	Death, reproduction inhibition, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of the accumulation of radionuclides in sediments	Although U concentrations are elevated with respect to livestock/human drinking water guidelines the relative short duration of the discharge makes the accumulation of radionuclides in sediment to a point that biota will be effected is unlikely. U unlikely to have detrimental effect radiologically at these concentrations as mode of action is typically via ingestion. ERICA modelling suggests sediment dwelling organisms are unlikely to be effected by radionuclide inputs at the population scale	D - Unlikely	3 - Moderate	9 - Low	Pre-treatment of water in soil ponds to lower concentrations of U prior to discharge.	D - Unlikely	2 - Minor	5 - Very Low	Rainfall likely to influence contaminant loads in the zone of discharge and across he river system as a whole
	Aquatic biota	Death, reproduction inhibition, physiological impairment at organism scale - population and species diversity effects at the population scale as a result of the recycling of radionuclides from sediments to the water column upon disturbance	Although some remobilisation of radionuclides from sediments to the water column is possible the majority will likely remain bound so sediment components thus reducing the content in the water column and decreasing the potential ecological risk.	D - Unlikely	2 - Minor	5 - Very Low	Pre-treatment of water in soil ponds to lower concentrations of U prior to discharge.	E- Rare	2 - Minor	3 - Very Low	

Risk Event / Pathway	Receptors	Potential Impacts	Key Considerations	Risk Assessment (Inherent)			Available Controls	Risk Assessment (Residual)			Other Comments
				Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
Increased Water within the Turner River System	Aquatic biota	Habitat loss/alteration, change in foodweb dynamics, change in physicochemical properties all leading to effects at both the organism and population scale	Turner River typically fluctuates between wet-dry, therefore 2.5 years of constant inundation has the potential to result in short-term effects.	C - Possible	2 - Minor	8 - Low	Ensuring discharge is contained within exisitng channels as planned	D - Unlikely	2 - Minor	5 - Very Low	As with many of the risk events assessed - rainfall within the catchment during the discharge window is critical in determining the overall significance of the risk
			Discharge likely to be contained to a 90m channel which means that <6% of the river will be continually inundated (River is 1.5km wide)								
			Rainfall within the discharge period will have a strong influence on ecological effects, however, the significance is open for debate as the ecosystem is a naturally fluctuating one.				Ecological monitoring to establish if any effects are occurring so that discharge plans can be altered if required.				
			For example if above-average rainfall occurs during the discharge period the effect of the discharge is in reality likely to be minimal as the river would have been in a wet-state regardless of whether the discharge took place.								
			Long term effects are less likely to be deleterious, however, given the inherent variability and fluctuating nature of the environment								
	Terrestrial biota	Habitat loss/alteration, change in foodweb dynamics, leading to effects at both the organism and population scale	Altered flow patterns of river has potential to eliminate or at least alter habitats used by terrestrial biota	D - Unlikely	2 - Minor	5 - Very Low	Ensuring discharge is contained within exisitng channels as planned	D - Unlikely	1 - Insignificant	2 - Very Low	As with many of the risk events assessed - rainfall within the catchment during the discharge window is critical in determining the overall significance of the risk
			Changes in aquatic foodwebs can also impact terrestrial species who utilise them as a food source								
			Higher trophic species likely to suffer more long term effects if ecosystems change i.e. food shortage, habitat loss etc				Ecological monitoring to establish if any effects are occurring so that discharge plans can be altered if required.				
			Discharge likely to be contained to a 90m channel which means that <6% of the river will be continually inundated (River is 1.5km wide)								
	Floodplain soils and vegetation	Habitat loss, soil degradation, altered inundation patterns for GDEs, weed recolonisation	Short term ecosystem-level effects are possible, particularly for GDE's and their adaptations to constant inundation vs wet/dry cycles	E - Rare	2 - Minor	3 - Very Low	Ensuring discharge is contained within exisitng channels as planned	E - Rare	1 - Insignificant	3 - Very Low	As with many of the risk events assessed - rainfall within the catchment during the discharge window is critical in determining the overall significance of the risk
			Long-term effects less likely to be significant as system likely to return to wet-dry cycling								
			Again the long-term effects are likely to be heavily dependent on annual rainfall as this has the potential to override the effects of the discharge				Ecological monitoring to establish if any effects are occurring so that discharge plans can be altered if required.				
			Discharge likely to be contained to a 90m channel which means that <6% of the river will be continually inundated (River is 1.5km wide). Highly unlikely floodplain soils and vegetation will be effected)								